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IS 8252-11 (1976): Environmental tests for aircraft equipment, Part 11: Differential pressure [TED 14: Aircraft and Space Vehicles]

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Indian Standard (Reaffirmed 2005)

ENVIRONMENTAL TESTS FOR AIRCRAFT EQUIPMENT

PART XI DIFFERENTIAL PRESSURE

1. Scope — Specifies tests to evaluate the effects of various pressure differential effects upon components or equipment used in aircraft.

1.1 Two tests are specified, namely, an excess pressure test and a rapid decompression test, each of which has a specific field of application. The relevant equipment specification shall prescribe the tests to be used and also the appropriate functional check.

2. General Test Requirements

2.1 *Test Requirements* — For the purpose of this standard, the appropriate conditions stated in IS : 8252 (Part I)-1976 'Environmental tests for aircraft equipment: Part I General', shall apply.

2.2 *Special Precautions* — To avoid damage during the tests, equipment having connections to the atmosphere external to the aircraft (for example, altimeters, airspeed indicators, machmeters, etc) shall be so connected as to simulate such conditions.

3. Excess Pressure Test

3.1 *Field of Application* — An excess pressure test is applicable to equipment mounted within the pressurized zone of an aircraft, its purpose being to demonstrate that the equipment will not be deranged by positive pressure applied when ground-testing aircraft pressure cabins.

The test need only be applied to equipment, having sealed enclosures (either pressurized or evacuated) or partially sealed enclosures having low leakage rates, which might be effected by an excess pressure condition.

3.2 *Procedure*

3.2.1 Equipment normally pressurized or evacuated shall have the internal pressure adjusted to the most adverse design limit that would be experienced at ground level.

3.2.2 The equipment shall be placed in the test chamber and orientated into its normal attitude, if this is significant, as required by the relevant equipment specification.

3.2.3 The test chamber shall be conditioned for a period sufficient to allow the equipment to stabilize at the test temperature stated in **3.3.1**.

3.2.4 The pressure within the chamber shall then be increased by the appropriate test pressure stated in **3.3.2**, in a period of not less than 5 minutes and not more than 15 minutes.

3.2.5 The pressure shall then be maintained at this level for a period of not less than 30 minutes and shall finally be restored to standard laboratory conditions in a period of not less than 5 minutes and not more than 15 minutes.

3.2.6 The equipment shall be subjected to this test in its idle or inert condition, unless it is a functional part of the aircraft during a pressurization check. In the latter event, the equipment shall be operated and made to function in the representative manner required by the relevant equipment specification.

3.3 *Test Condition*

3.3.1 The test shall be applied initially at the temperature corresponding to standard laboratory conditions and additionally, if temperature is likely to contribute to failure, at −20°C and +70°C.

3.3.2 The appropriate test pressure for the aircraft covered by this standard shall be as given in Table 1.

TABLE 1 PRESSURES FOR EXCESS PRESSURE TESTS

Relevant Equipment Grade*	Maximum Pressure Differential† kPa	Differential Test Pressure‡ $\text{kPa}^{+5}_{\ 0}\%$
A	76	85

*The equipment grade stated here corresponds to that covered in Part II dealing with temperature, pressure and humidity which is under preparation.

†The pressurization level for ground testing has been assumed equal to the maximum level occurring in flight for the particular class of aircraft.

‡The test pressure is based on a proof test concept and is the maximum pressure differential multiplied by 1·125.

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3.4 *Information to be Stated in the Relevant Equipment Specification* — When this test is a requirement in the equipment specification, the following details shall be stated, as far as they are applicable:

	Relevant Sub-clauses
a) Orientation of equipment in the chamber	3.2,2
b) Test severities, for example:	
1) test temperature	3.2.3
2) test pressure	3.2.4
c) Operative conditions of the equipment	3.2.6
d) Phases of the test when performance check is to be made	2.1

4. Rapid Decompression Test

4.1 *Field of Application* — A rapid decompression test is applicable to equipment mounted within the pressurized zone of an aircraft. Its purpose is to demonstrate that, in the event of a pressurization supply failure or a structural failure of the aircraft causing a rapid but not explosive loss of pressurization, the equipment will survive or will fail in such a manner as not to hazard the safety of the aircraft.

Guidance on the conduct of rapid decompression tests is given in Appendix A.

4.2 *Procedure*

4.2.1 Equipment normally pressurized or evacuated shall have the internal pressure adjusted to the most adverse design limit that would be experienced at ground level.

4.2.2 The equipment shall be placed in the test chamber and orientated into its normal attitude, if this is significant, as required by the relevant equipment specification.

4.2.3 The test chamber shall be conditioned for a period sufficient to allow the equipment to stabilize at the test temperature stated in **4.3.1**.

4.2.4 The pressure within the chamber shall then be reduced to the appropriate pressurization level stated in **4.3.2**, and shall be maintained at this level for a period of not less than 5 minutes.

4.2.5 The pressure shall then be further reduced to that corresponding to the appropriate maximum flight altitude stated in **4.3.2** in a period not exceeding 1 minute or, if allowed by the relevant equipment specification, at the maximum rate of change obtainable in the test chamber (*see also* Appendix A).

4.2.6 The pressure shall then be maintained at that level for a period not less than 10 minutes, or as required by the relevant equipment specification.

4.2.7 The relevant equipment specification may require the temperature to be changed to simulate temperature levels resulting from pressurization failure, and/or the pressure to be increased to simulate descent to a more acceptable flight altitude.

4.2.8 Unless the test is being made with equipment in its idle or inert state, the equipment shall be operated and its performance assessed at the phases of the test stated in the relevant equipment specification.

4.3 *Test Conditions*

4.3.1 The test shall be applied initially at the temperature corresponding to standard laboratory conditions and additionally, if temperature is likely to contribute to failure, at +45°C or −20°C or both.

4.3.2 The appropriate pressure requirements for the aircraft covered by this standard shall be as given in Table 2.

TABLE 2 PRESSURES FOR RAPID DECOMPRESSION TESTS

Relevant Equipment Grade*	Use in Aircraft Class*	Pressurization Level†	Test Pressure Related to Maximum Flight Altitude
		kPa $^{+5}_{0}$% absolute	kPa ± 5% absolute
A	II	87·5	11·5
A	IV	80·5	4·5

*The equipment grade and aircraft class stated here correspond to those covered in Part II dealing with temperature, pressure and humidity which is under preparation.

†The test condition stated above is based upon a pressurization where the differential is 76 kPa.

4.4 *Information to be Stated in the Relevant Equipment Specification* — When this test is a requirement in the equipment specification, the following details shall be stated, as far as they are applicable:

	Relevant Sub-clauses
a) Whether the test is a demonstration of performance or survival	4.1
b) If performance is to be assessed, the phases of the test cycle when the equipment is to be operated and the performance evaluation carried out	4.2.8 and 2.1
c) Mounting of equipment, if relevant	4.2.1 and 2.1
d) Test severities, for example:	
1) pressurization level	4.2.4
2) test pressure related to maximum flight altitude	4.2.5
3) temperature(s)	4.2.3
e) Whether a rate of change lower than 1 min is allowed	4.2.5
f) Duration of maximum flight altitude	4.2.6
g) Conditioning following decompression phase, stating temperature and pressure	4.2.7

APPENDIX A

(*Clauses* 4.1 *and* 4.2.5)

GUIDANCE ON THE CONDUCT OF RAPID DECOMPRESSION TESTS

A-1. General — The effects of pressure change only can be considered in the decompression phase of the test for, although temperature may change as a result of failure, such changes are unlikely to influence an equipment immediately; furthermore, it is not practicable to reproduce a rapid temperature change simultaneously with the pressure change. If the effects of such temperature change are likely to be significant in the subsequent performance of the equipment, the temperature change to be applied should be stated in the relevant equipment specification (*see* **4.2.7**).

A-1.1 It is expected that pressurization failure would be followed by descent of the aircraft to a more acceptable flight altitude; the very low air pressure following a failure would thus persist for a limited period only. If the effects of a descent to low altitude are significant to the equipment, the pressure changes to be applied should be stated in the relevant equipment specification (*see* **4.2.7**).

A-1.2 For aircraft with a large cabin volume, descent may be initiated before all pressurization has been lost and equipment would therefore be subjected to a pressure change less than that stated above. In such cases the requirements shall be based on known or estimated characteristics of the particular aircraft.

A-1.3 The rate of change of pressure specified in **4.2.5** may be difficult to achieve in most test chambers. For many items of equipment, this rate of pressure change would not be significant and, in such cases, the requirement may be relaxed to the maximum rate of change obtainable in the test chamber.

A-2. Performance Evaluation — In general, the hazards resulting from rapid decompression can be defined as follows:

a) Physical break-up of an equipment interfering with either operation of adjacent equipment or any aircraft function.

b) Loss of operation of equipment necessary for flight safety during and/or following a pressurization failure.

A-2.1 Where mechanical or electric functioning are to be demonstrated, the equipment should be operated and the performance assessed at appropriate phases of the test. If, however, only mechanical integrity is to be demonstrated, the equipment may be subjected to the test in the idle state.

A-2.2 Equipment needing to operate without loss of function throughout the rapid decompression and subsequent phases should be brought into operation before the decompression phase is applied.

A-2.3 In the case of heat-generating equipment, it may be required to allow the temperature of the equipment to restabilize before applying decompression (*see* **4.2.5**). The performance of such equipment should be monitored throughout the test.

A-2.4 In the case of equipment required to function only following decompression, temporary derangement of the equipment at pressures corresponding to maximum flight altitude may be acceptable provided that function is restored after descent to a more acceptable altitude.

A-2.5 Equipment operating intermittently in flight should be demonstrated in the operational or inert state, whichever is the more adverse.

APPENDIX B

CONVERSION TABLE OF PRESSURE UNITS

B-1. The following table giving conversions of the pressures in SI units used in this standard is provided for information.

Test Pressure	Approximate Maximum Flight Altitude		Equivalent Test Pressure in Non-SI Units			
kPa (kN/m^2) (Absolute)	m	ft	mbar	mmHg	inHg	lbf/in^2
4·5	21 300	70 000	45	33·8	1·33	0·653
11·5	15 200	50 000	115	86·3	3·40	1·669
76·0	—	—	760	570	22·40	11·02
80·5	—	—	805	604	23·78	11·68
85·0	—	—	850	638	25·12	12·34
87·5	—	—	875	656	25·83	12·68

EXPLANATORY NOTE

This standard is a part of a series of Indian Standards specifying simulated environmental tests to which aircraft equipment is to be subjected to demostrate that it would function satisfactorily under normal aircraft operating conditions. The relevant equipment specification shall define the appropriate test severities and the criteria for correct functioning.

This Indian Standard is based on Draft International Standard ISO/DIS 2660 'Environmental tests for aircraft equipment — Part 2.10 Differential pressure', issued by International Organization for Standardization.

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